

Google Colab for Mechanical Engineering

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Introduction to Google Colab

Google Colab is a cloud-based platform that allows users to run Python code without needing local installations. It provides free GPU access, seamless integration with Google Drive, and easy dataset management.

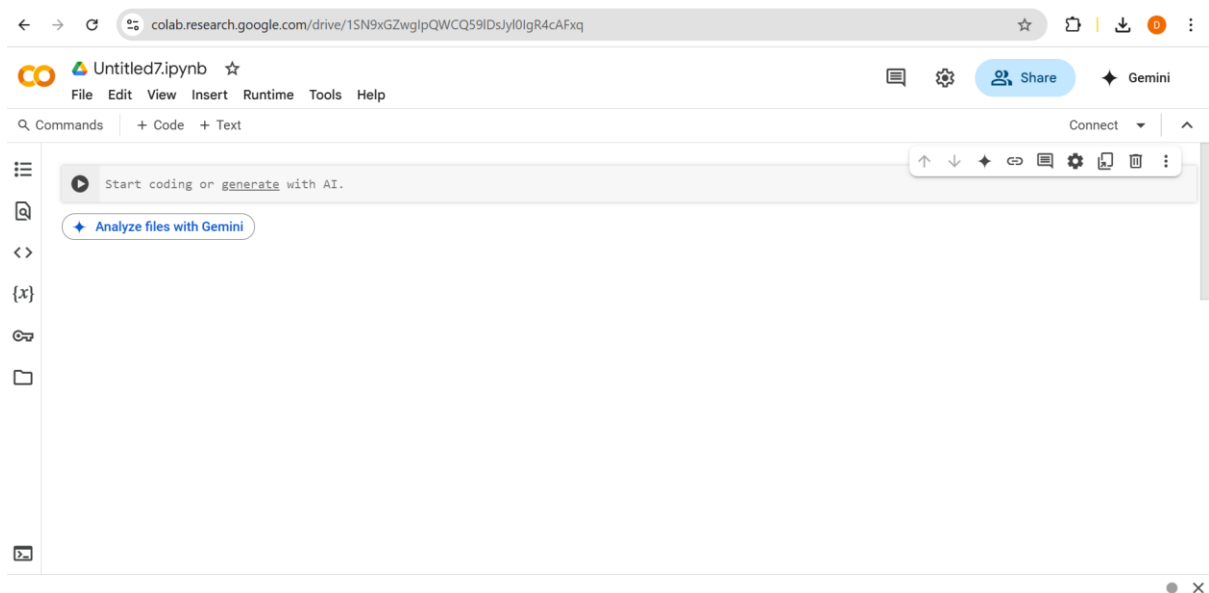
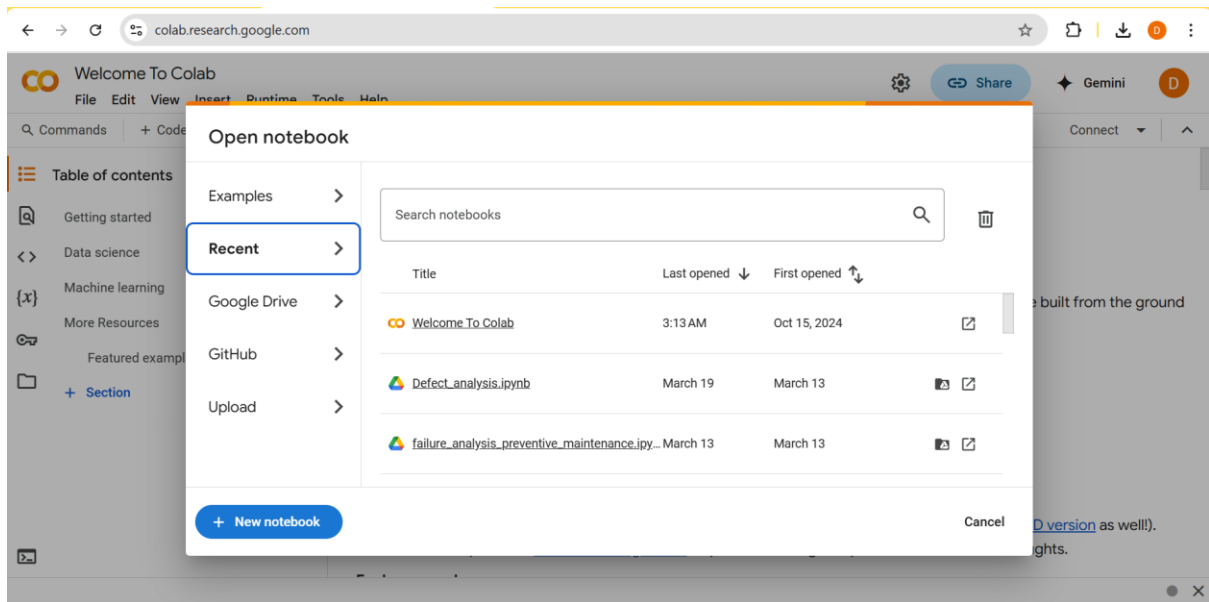
Applications in Mechanical Engineering

- **Data Analysis:** Processing manufacturing and sensor data.
- **Predictive Maintenance:** AI-driven fault detection and machine learning.
- **Quality Control:** Automating defect detection using image processing.
- **Simulation and Optimization:** Using AI to optimize mechanical systems.

1. Signing into Google Colab

To access Google Colab, follow these steps:

1. Go to [Google Colab](https://colab.research.google.com/).
2. Sign in with your Google account.
3. Click on **"New Notebook"** to start coding.
4. To access previous work, navigate to **"Google Drive > Colab Notebooks"**.



Creating a New Notebook

2. Creating a Dataset in Google Colab

You can create a dataset directly within Colab using Pandas.

```
import pandas as pd
```

```
# Creating a sample dataset of machine parameters
```

```
data = {
```

```
    'Machine_ID': [101, 102, 103, 104],
```

```
'Temperature': [75, 80, 78, 85],

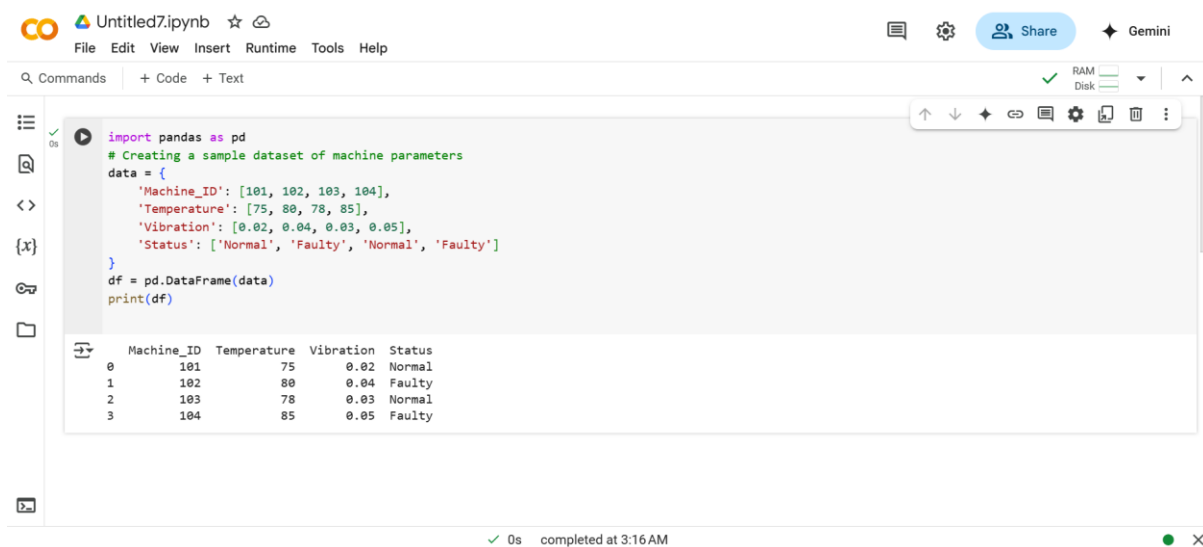
'Vibration': [0.02, 0.04, 0.03, 0.05],

'Status': ['Normal', 'Faulty', 'Normal', 'Faulty']

}

df = pd.DataFrame(data)

print(df)
```



The screenshot shows a Jupyter Notebook titled 'Untitled7.ipynb'. The code cell contains the following Python code:

```
import pandas as pd
# Creating a sample dataset of machine parameters
data = {
    'Machine_ID': [101, 102, 103, 104],
    'Temperature': [75, 80, 78, 85],
    'Vibration': [0.02, 0.04, 0.03, 0.05],
    'Status': ['Normal', 'Faulty', 'Normal', 'Faulty']
}
df = pd.DataFrame(data)
print(df)
```

The output of the code is a DataFrame with 4 rows and 5 columns:

	Machine_ID	Temperature	Vibration	Status
0	101	75	0.02	Normal
1	102	80	0.04	Faulty
2	103	78	0.03	Normal
3	104	85	0.05	Faulty

The status bar at the bottom indicates that the code was completed at 3:16 AM.

3. Saving and Loading a Dataset as CSV

#Saving a CSV File in Colab

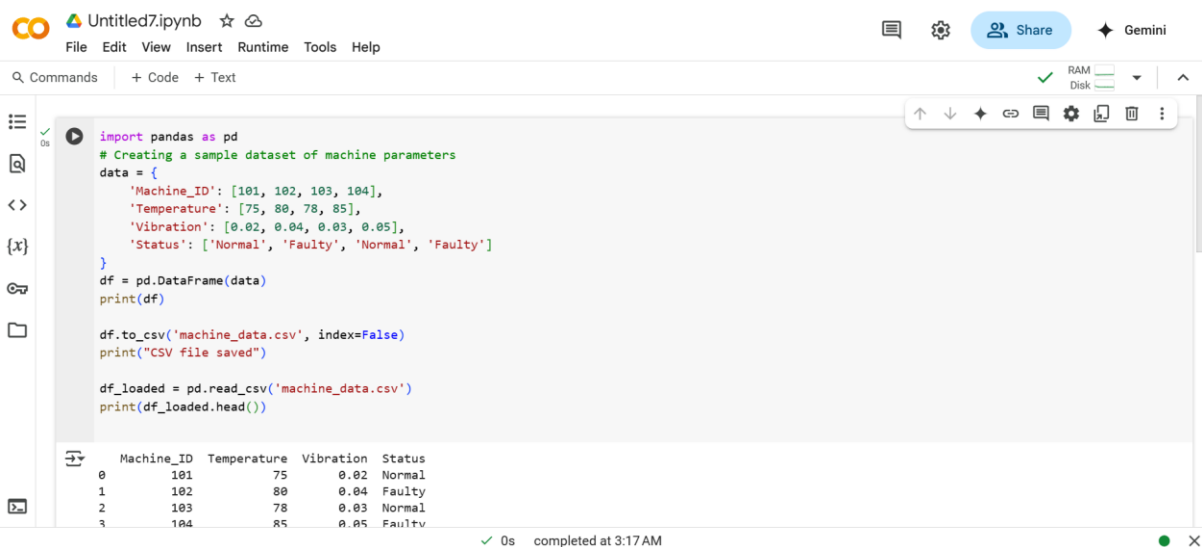
```
df.to_csv('machine_data.csv', index=False)

print("CSV file saved")
```

#Loading a CSV File from Colab

```
df_loaded = pd.read_csv('machine_data.csv')

print(df_loaded.head())
```



```

import pandas as pd
# Creating a sample dataset of machine parameters
data = {
    'Machine_ID': [101, 102, 103, 104],
    'Temperature': [75, 80, 78, 85],
    'Vibration': [0.02, 0.04, 0.03, 0.05],
    'Status': ['Normal', 'Faulty', 'Normal', 'Faulty']
}
df = pd.DataFrame(data)
print(df)

df.to_csv('machine_data.csv', index=False)
print("CSV file saved")

df_loaded = pd.read_csv('machine_data.csv')
print(df_loaded.head())

```

	Machine_ID	Temperature	Vibration	Status
0	101	75	0.02	Normal
1	102	80	0.04	Faulty
2	103	78	0.03	Normal
3	104	85	0.05	Faulty

0s completed at 3:17 AM

4. Mounting Google Drive in Colab

To access files stored in Google Drive, mount it using the following command:

```
from google.colab import drive
```

```
drive.mount('/content/drive')
```

Once mounted, you can read/write files as:

```
file_path = '/content/drive/My Drive/machine_data.csv'
```

```
df.to_csv(file_path, index=False)
```

5. Integrating Maintenance Data with Google Colab

Mechanical industries use **AI-driven maintenance strategies** to enhance productivity. Below is a summary of key maintenance types and how they integrate with Colab:

Types of Maintenance in Manufacturing

1. **Reactive Maintenance (Run-to-Failure):** AI models in Colab can detect faults after failure.
2. **Preventive Maintenance:** IoT sensor data processed in Colab schedules routine servicing.
3. **Predictive Maintenance:** AI analyzes real-time sensor data to predict failures.
4. **Condition-Based Maintenance:** Uses real-time conditions instead of fixed schedules.
5. **Prescriptive Maintenance:** AI not only predicts failures but suggests corrective actions.
6. **Autonomous Maintenance:** Self-healing machines report and fix minor issues.

7. **Total Productive Maintenance (TPM):** AI dashboards track performance and enable workers to act proactively.

Example: Predictive Maintenance Using Google Colab

```
import numpy as np

from sklearn.linear_model import LogisticRegression

# Simulated sensor data

X = np.array([[75, 0.02], [80, 0.04], [78, 0.03], [85, 0.05]]) # Temperature & Vibration

y = np.array([0, 1, 0, 1]) # 0: Normal, 1: Faulty

# Training a simple machine learning model

model = LogisticRegression()

model.fit(X, y)

# Predict machine status

new_data = np.array([[82, 0.03]])

prediction = model.predict(new_data)

print("Predicted Status:", "Faulty" if prediction[0] else "Normal")
```

Conclusion

Google Colab provides a powerful environment for mechanical engineers to work with AI, data analysis, and predictive maintenance without requiring advanced local setups. Its integration with Google Drive enables seamless dataset management, making it ideal for industrial applications in **maintenance, quality control, and simulation.**

GitHub Repository

<https://github.com/deepakrll/ML-Mechanical-Preventive-Maintenance>